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# *Thyroid Functions with Cases of Hyperemesis Gravidarum in Saudi Women*

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**ABSTRACT**

*Varying degrees of hyperthyroidism have been found in 30% to 60% of women with hyperemesis gravidarum. The spectrum of clinical indicators ranges from subclinical hyperthyroidism, where there is an isolation of biochemical evidence of low TSH and mildly elevated serum T4 concentration levels, to clinical hyperthyroidism (gestational thyrotoxicosis). In rare cases, manifestations as severe as thyroid storm may occur. The purpose of the current study is to explore the association between hyperthyroidism and hyperemesis gravidarum in Saudi women. To achieve this objective, 100 pregnant women at 6-13 weeks of gestation were divided into two groups of 50 women each. First group (control): women with normal pregnancies who experienced emesis and were treated in the outpatient clinic. The second group (case): women with severe repeated vomiting who required hospital admission (hyperemesis gravidarum). None of the women had been diagnosed with hormonal dysfunction before pregnancy. However, analysis of thyroid functions found elevated serum FT3 and FT4 levels in a significant number of women with hyperemesis compared to the control group (26% vs 2%) and (44% vs 6%) respectively. Likewise, a significant number of women (72%) in the case group showed lower than normal mean TSH levels compared to only 6% of those in the control group. Hyperthyroidism was clearly detected in the present study, but it did not reach levels requiring antithyroid medication. This suggests that the biochemically altered thyroid function found in women who are clinically euthyroid may be responsible for their hyperemesis and may be one reason that the condition continues into the second trimester.*

***Key words:*** *Hyperemesis gravidarum, thyroid function, hCG, Saudi women*

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## INTRODUCTION

Some pregnant women experience the condition known as hyperemesis gravidarum, which is marked by persistent, often severe, nausea and vomiting with associated ketosis[1]. They may also lose more than 5% of their pre-pregnancy weight. Hyperemesis gravidarum can also result in dehydration, nutritional deficiencies, abnormalities in the electrolyte and acid-base balance, and in the most severe cases, even death [2]. Hospital admission is required for severe hyperemesis in 0.3-2% of pregnancies [3].Intravenous rehydration therapy has greatly reduced the mortality rate from hyperemesis gravidarum [2-3].

During pregnancy, particularly in the first trimester, changes in thyroid function test values occur, primarily due to estrogen-induced rises in the levels of serum thyroxin-binding globulin (TBG) and hCG-induced increase in the thyroid hormone synthesis and release [4]. Thyroid disease often starts to appear during a woman's reproductive years andis the second most common hormonal condition affecting women in this period of their lives.Thephysiologic changes which occur in pregnancy may be similar to symptoms of thyroid disease. They can alsolead to a true remission or make the underlying disease worse. Thyroid hormones also play an important role in fetal brain development [5]. Varying degrees of hyperthyroidism have been found in 30% to 60% of women suffering from hyperemesis gravidarum [6].Most of the time, this hyperthyroidism is temporary, resolving itself with the cessation of vomiting [7]. The spectrum of clinical indicators ranges from subclinical hyperthyroidism, where

there is isolated biochemical evidence of low TSH and mildly elevated serum T4 concentration levels, to clinical hyperthyroidism (gestational thyrotoxicosis) [8]. In rare cases, manifestations as severe as thyroid storm may occur. Treating the hyperthyroidism stops the vomiting in some cases, but in other patients, hyperemesis persists despite thehyperthyroidism being resolved [9]. Furthermore, not all hyperthyroid patients experience severe vomiting, while hyperemesis has been reported in some patients with hypothyroidism. In addition,hyperemesis is not seen in all women with gestational thyrotoxicosis or Graves' disease [9-10].

An hCG isoform with high biologic and immunologic activity has been found in women with hyperemesis gravidarum [11]. In normal pregnancy, maximum levels of hCG concentration are 30 to 100 u/ml, peaking at the 8th to 12th week [12]. An inverse correlation has been reported between this peak andTSHconcentration. Conversely, there is a direct correlation between hCGlevels and free thyroxin (T4) concentration, although the free T4 levelsusuallydonot rise above the normal range.In addition, there has been a direct correlation reported between serum hCG levels and thyroid-stimulating activity [12-13].

## MATERIALS AND METHODS

The present prospective case - control study aimed to assess the thyroid functions (serum FT3, FT4 and TSH) in women with hyperemesis gravidarum. The study wasconducted in the Department of Obstetrics and Gynecology at King Abdulaziz University Hospital, Jeddah, Saudi Arabiabetween October 2014 and April 2015.It was approved by the Biomedical Committee at the Faculty of Medicine, King Abdulaziz University.

The subjectswererandomly selected 100 pregnant women at 6-13 weeks of gestation, subdivided into two groups:

1$^{st}$group (control group): 50 women with normal pregnancieswho experienced emesis and were treated in the outpatient clinic.

2$^{nd}$group (case group): 50 women with severepersistent vomiting who required admission to thehospital (hyperemesis gravidarum).

All subjects involved in this study met the following inclusion criteria and exclusion criteria:

**Inclusion criteria**

Singleton pregnancy, viable fetus, first trimester (6-13 weeks), nausea and vomiting with weight loss and body mass index (BMI): 20 – 24.9kg/m$^2$

**Exclusion criteria:**

Multiple pregnancies, hydatidiformmole, thyroid diseases, medical disorders (e.g. pyelonephritis, pancreatitis, psychological disorder, peptic ulcer, diabetes mellitus), and severely deteriorated cases (e.g. encephalopathy).

All the women were informed about the nature of the study and anyone who did not agree to participate was excluded. Sociodemographic and medical information was obtained from each participant. Additionally, each subject underwent a complete physical examination including abdominal ultrasound to confirm gestational age and normality of pregnancy and to rule out any complications which may result in hyperemesis gravidarum. The following investigations were also carried out on each participant: full blood count; midstream urineexamination; serum electrolytes level (sodium, potassium(mmol/L)); liver function test; renal function test;and thyroid function tests[fasting serum thyroid stimulating hormone, free T3, free T4], which weremeasured by radioimmunoassay.

**Statistical Analysis**

Statistical presentation and analysis of the present data was conducted, using the mean, standard error, Kruskal-Wallis and analysis of variance [ANOVA] and Mann-Whitney tests using SPSS version 20.0 SPSS Inc., Chicago, IL, USA).Continuous variables were analyzed as mean values ± standard deviation (SD) or median (range) as appropriate. Percentages were calculated for categorical data. For categorical variables, differences were analyzed with $\chi 2$ (chi square) tests and Fisher's exact test when appropriate.

Mean X: to measure the central value of a group of data.

$$1.\ \underline{\text{Mean}} = \frac{\Sigma x}{n}$$

Where Z = sum & n = number of observations

2- Standard deviation (SD):to measure the degree of dispersion of data around the mean value.

$$SD = \sqrt{\frac{\Sigma |x - x|^2}{n-1}}$$

Standard Error FSE1:

$$SE = \frac{SD}{\sqrt{n}}$$

P > 0.05 non-significant (NS),< 0.05 significant (S).

**RESULTS**

As seen in the Table (1), a significant correlation exists between gestational age and FT3 and TSH, while the correlation between gestational age and FT4 is not significant. Mean FT3 and FT4 values are highestwhen the gestational age is between 8 and 12 weeks, while mean values for both hormones appear at their lowest level in women who are 8 weeks or less into their pregnancies. Mean TSH values are lowest in the 8-12-week gestational age range, while the highest mean TSH value appears at 8 weeks or less.

Table (1): Correlation between gestational age and thyroidprofile in the study group:

| variable | Gestational Age | | | F | P | Sig |
|---|---|---|---|---|---|---|
| | < 8w (n = 11) | 8-12w (n = 32) | > 12w (n = 7) | | | |
| **FT3** | 2.30 ± 0.68 | 3.12 ± 0.96 | 2.74 ± 1.07 | 3.285 | 0.046***** | S |
| **FT4** | 1.45 ± 0.44 | 1.82 ± 0.58 | 1.76 ± 0.63 | 1.864 | 0.166 | NS |
| **TSH** | 0.37 ± 0.27 | 0.13 ± 0.21 | 0.20 ± 0.31 | 4.249 | 0.020***** | S |

** Significantp<0.05*

As illustrated in table (2) shows that, there is no significant correlation was found between parity and FT3, FT4 and TSH levels in the study group

Table (2): Comparison between primigravida and multipara in the studygroup as regards FT3, FT4 and TSH levels.

| Variable | Parity | | T | P | Sig |
|---|---|---|---|---|---|
| | PG (n = 30) | MP (n = 20) | | | |
| **FT3** | 2.93 ± 1.01 | 2.82 ± 0.92 | 0.409 | 0.684 | NS |
| **FT4** | 1.77 ± 0.58 | 1.67 ± 0.56 | 0.605 | 0.548 | NS |
| **TSH** | 0.19 ± 0.23 | 0.20 ± 0.29 | 0.202 | 0.841 | NS |

** Significant p<0.05*

As seen in the table (3), there is no significant difference between the two groups in maternal age, calculated gestational age and BMI.

Table (3): Demographic data of women involved in the study:

| Characteristics | Group | N | Mean | Std. Deviation | Pvalue | Sig |
|---|---|---|---|---|---|---|
| **Maternal age (yrs)** | Patients | 50 | 24.16 | 3.58 | 0.78 | NS |
| | Control | 50 | 23.96 | 3.85 | | |
| **Gestational age (wks)** | Patients | 50 | 9.44 | 2.24 | 0.80 | NS |
| | Control | 50 | 9.54 | 1.88 | | |
| **BMI** | Patients | 50 | 22.62 | 1.11 | 0.22 | NS |
| | Control | 50 | 22.33 | 1.21 | | |

**Significant p <0.05*

Data seen in table (4) shows a highly significant difference in the levels of FT3 and FT4 between the case group and the control group. With both hormones, the levels in the case group are significantly higher. Conversely, levels of TSH are significantly lower in the case group than in the control group.

Table (4): Comparison between the case and control groups as regards FT3, FT4, andTSH levels.

| Variable | Group | N | Mean | Std. Deviation | P value | Sig |
|---|---|---|---|---|---|---|
| **FT3** | **Patients** | 50 | 2.88 | 0.97 | 0.018* | S |
| | **Control** | 50 | 2.51 | 0.51 | | |
| **FT4** | **Patients** | 50 | 1.73 | 0.57 | 0.000* | S |
| | **Control** | 50 | 1.08 | 0.30 | | |
| **TSH** | **Patients** | 50 | 0.19 | 0.25 | 0.000* | S |
| | **Control** | 50 | 1.02 | 1.08 | | |

** Significant p<0.05*

Table (5) shows that there is no significant correlation could be detected between the degree of ketonuria (+1, +2, +3) and FT3 – FT4 – TSH in the case group.

**Table (5):** Comparison in the case group as regards ketone in urine (+1, +2 or+3):

| Variable | Ketone in urine | N | Mean | Std. Deviation | Std. Error | F value | Sig |
|---|---|---|---|---|---|---|---|
| **FT3** | + | 34 | 2.91 | 0.95 | 0.16 | 0.888 | NS |
| | ++ | 11 | 2.91 | 1.07 | 0.32 | | |
| | +++ | 5 | 2.68 | 1.05 | 0.47 | | |
| **FT4** | + | 34 | 1.72 | 0.55 | 0.09 | 0.934 | NS |
| | ++ | 11 | 1.73 | 0.68 | 0.21 | | |
| | +++ | 5 | 1.82 | 0.58 | 0.26 | | |
| **TSH** | + | 34 | 0.17 | 0.23 | 0.04 | 0.529 | NS |
| | ++ | 11 | 0.27 | 0.29 | 0.09 | | |
| | +++ | 5 | 0.16 | 0.30 | 0.14 | | |

** Significant p<0.05*

## DISCUSSION

In the present study, 20% of the women with hyperemesis gravidarum were 8 weeks pregnant or less, 62% of them were at a gestational age of 8-12 weeks and18% of the women were more than 12 weeks pregnant. There was a significant correlation between mean FT4and TSH values and gestational age (p=0.046, p=0.020 respectively). On the other hand, there was no significant association between mean FT3 and gestational age (p=0.166). The highest

mean FT3 and FT4 levels were found at gestational age of 8-12 weeks, while the lowest corresponding mean values were found at a gestational age of up to 8 weeks. Conversely, the lowest mean TSH values were seen at a gestational age of 8-12 weeks, while the highest mean values of the hormone were seenat a gestational age of up to 8 weeks.

In their study, Gill et al. [14] reported that 82% of women experienced vomiting at less than 12 weeks of pregnancy, which is when hCG levels reach their peak. Likewise, Al-Yatama et al. [15] found a correlation between the highest incidence of hyperemesis gravidarum and peak levels of beta-subunit of human chorionic gonadotropin (ßhCG), generally occurring at a gestation age of 8-10 weeks. A similar phenomenon was also reported byGanguli et al [16], who observed vomiting in 93.3% of women who were less than 12 weeks into their pregnancies.

Demographic data was similar in the two groups of participants, with no significant difference seen between the case and control groups regarding maternal age and gestational age.

In the current study, none of the women presented with thyrotoxic manifestations. However, analysis of thyroid functions showed an elevation of serum FT3 levels (normal range 1.63 -3.77pg/ml) in a significant number of hyperemetic women compared to those in the control group (26% *vs* 2%). Therise in mean FT3 level in the case group (2.88±0.97 *vs*2.51±0.51 pg/ml) was statistically significant (p=0.018). In 6% of hyperemetic women compared to only 2% of those in the control group, the mean FT3was found to less than 1.63 pg/ml.

An increase in serum FT4 levels (normal range 0.89 – 1.79ng/dl) was found in a significant number of hyperemetic women compared to the control group (44% *vs* 6%). The elevation in mean FT4 level (1.73±0.57 *vs*1.08±0.30 pg/ml) was statistically significant (p = 0.000). None of the hyperemetic women had serum FT4 levels of less than0.89 ng/dl, while 10% of women in the control group had levels less than normal.

In contrast, mean TSH levelswere found to be significantly lower (0.19±0.25 *vs*1.02±1.08 mIU/L) in the hyperemetic women than in those with normal pregnancies(p=0.000).Serum TSH levels were below normal (0.17-4.05 mIU/L) in 72% of the women in the case group, whereas only 6% of the women in the control group had such low TSH levels.

The findings of the present study are largely consistent with those of Panesar et al. [9], who found a significant difference between women with hyperemesis (n=58) and those without (n=58) in regard to maternal age and all hormones (thyroid stimulating hormone, free thyroxine, free triiodothyronine and total beta human chorionic gonadotropin).

Our findings agree with Al-Yatama et al. [15].In their study on Kuwaiti women, they found the group with hyperemesis gravidarum (n=50, with ketonuria 3+ or more on dip stick examination) had significantly higher hormone levels than the control group, with TT4 values of 11.1±3.66 versus 9.21±2.30µ g/dl (p<0.004) and FT4 values of 1.45±0.39 compared to 1.28±0.23 (p<0.01). As in the present study, levels of TSH were found to be significantly lower in the hyperemetic women than in the control group: 0.34 compared to 1.74 mIU/ml (p<0.0001). However, although both TT4 and FT4 hormone titers were significantly higher in the study group, their values were still within the normal range. TSH values, on the other hand, were found to be less than the normal range in the study group. Researchers found a robust positive association between the ßhCGtiter and the incidence of hyperemesis gravidarum. TT4 and FT4 levels also correlated positively with the incidence of hyperemesis in the study group. This suggests that higher levels of ßhCG in the hyperemetic women had a stimulatory effect on the thyroid gland. This is in line with reports of ßhCG's thyrotrophic role in humans [17].

However, unlike in the study done by Al-Yatama et al. [15], in the present study, none of the participants exceeded a gestational age of 13 weeks. Another difference in the two studies is that in the Kuwaiti study, women with thyroid disorders were identified by measuring thyroid microsomal antibodies and were subsequently excluded from the study. This step was not feasible in the present study.

In a study conducted in Turkey, Leylek et al. [18] reported that women with hyperemesis gravidarum (n=24) had significantly higher levels of mean serum hCG, free T3, and free T4 than did the healthy controls (n=20)

(p<0.007).Their study, however, did not find a statistically significant difference between the case and control groups in terms of TSH, which contrasts with the current finding.

The present study agrees with Gill et al. [14], in their study conducted in India. Analysis of thyroid functions revealed elevated serum T3 values (>1.66ng/ml) in a significant number of hyperemetic women (22% *vs* 8% of the controls). However, this difference in mean T3 level(1.70±2.9 *vs* 1.24±0.35ng/ml) did not reach statistical significance (p>0.05). Greater serum T4 levels (>12.00ng/dl) were found in 67% of the women with hyperemeticgravidarum as compared to only 16% of those with normal pregnancies. The mean T4 levels found in the hyperemetic women were significantly higher than in the control group (14.10±3.28 *vs* 9.89±2.46 ng/dl), (p< 0.001). Levels of serum TSH were less than normal(<0.47_IU/ml) in 18%of the women with hyperemesis, whereas only 8% of those with normal pregnancies had lower than normal TSH levels. The study group had a significantly lower mean TSH level (1.70±1.16 *vs* 2.36±1.33) compared to the control group (p<0.01).

The findings of the present study support those from a study Tan et al. [19]carried out in Singapore. Analysis of thyroid function was conducted on 87 women admitted to the hospitalfor hyperemesis gravidarum. Fifty-three (60.9%) of them were diagnosed with hyperthyroidism. After excluding nine women due to incomplete follow up, researchers identified 39 of the remaining 44 women with transient hyperthyroidism of hyperemesis gravidarum and five women with Graves' disease based on clinical signs and thyroid antibody profile. The presence of goiter (in an iodine-replete population) and a heart rate persistently over 120 beats per minute (even after hydration) were the two clinical features used todifferentiate between transient hyperthyroidism of hyperemesis gravidarum and Graves' disease. Tan et al. [19]found all the women in the transient hyperthyroidism of hyperemesis gravidarum group to be clinically euthyroid, which is in agreement with the findings of the present study.

The findings of Goodwin et al. [13], in research carried out at the University of Southern California, USA also agree with the current study.They reported lower levels of TSH in 60% of the hyperemetic patients (n=57)versus 9% of women in the control group (n=57). Women with hyperemesis had significantly higher values of mean serum hCG, free T4, total T3, and estradiol, and lower serum TSH levels compared to controls. Hyperemeticwomen with reduced TSH had significantly elevated free T4 and hCG values compared to those whose TSH levels were in the normal range. The severity of vomiting was directly proportional to the degree of biochemical hyperthyroidism and hCG concentration.

In the present study, the majority of patients with hyperemesis gravidarum (68%) reported more than four episodes of vomiting in the 24 hours preceding their hospitaladmission. Although it did not reach levels of statistical significance, there was a trend for hypokalemia to be associated with suppressed FT3 levels (p= 0.321) and slightly lower levels of FT4 (p=0.169). Likewise, hyponatremia showed a non-significant association with lower FT3 levels (p=0.052) and slightly higher FT4 levels (p=0.062).

Although weight loss is an important independent and quantifiable measure of the severity of hyperemesis gravidarum, the present study did not include this as an index of the severity of the conditiondue to difficulties inexact measurement. While all of the hyperemetic women reported noticeable weight loss, most of them did not know their exact preconception weight, making it impossible to quantify weight loss.

In our study, hypernatremia was found in 38% (n=21) of the patients with hyperemesis gravidarum, while hypokalemia was present in 56% (n=28) of the patients. Greater levels of ALT were observed in 38% (n=19) of the hyperemeticpatients, with elevated AST levelsfound in 52% (n=26) of the patients.Jaundice indicates fatty infiltration of the liver and kidneys [15]. In the current study, hyperbilirubinemia was seen in threehyperemetic patients, all of whom had elevated liver enzymes and low levels of potassium.

Elevated FT4 levels were found in all of the women with hyperbilirubinemia, while one had elevated FT3. Two patients in the study group had bouts of hematemesis; one patient had laryngitis and experienced mood changes. Only two cases were admitted to the intensive care unit. Apart from these, none of the patients had any life-threatening complication, nor did their conditions deteriorate.

All hyperemetic women in our study responded to measures treating the general symptoms. Intravenous fluids were given to all the patients and input and output was monitored. Oral intake of food and fluids was withheld until vomiting stopped, then oral feeding was gradually reintroduced. None of the patients in the present study required completeparenteral nutrition. Antiemetic drugs, specifically metoclopramide 10mg and a mixture of adrenocortical extracts and vitamin B6 (Cortigen B6), were administered parenterally. Ranitidine 50mg injections weregiven to all cases. Vitamin Bl (100mg), B6 (l00mg) and B12 (1mg) were given to all patients in the form of intramuscular injections. Eight women were givenparenteral potassium replacement therapy. Ondansetron 4mg was prescribed for ninepatients, while hydrocortisone 100mg injections wereprescribed for only three.

None of the hyperemesisgravidarum patients in the present study received treatment with antithyroid agents. This contrasts with Farzad et al. [20], who reported that 20% of the patients in their study on hyperemesis gravidarum needed anti-thyroid therapy.They recommended routine thyroid function tests for women with hyperemesis gravidarum, especially those presenting with clinical signs of hyperthyroidism. They further suggested that women who have persistent vomiting and hyperthyroxinemia after a gestation age of 18-20 weeks should be considered for treatment with antithyroid drugs, especially when the hyperemesis gravidarum is accompanied by severe weight loss and biochemical hyperthyroidism.

The findings of the current study are also different from those ofElOrabi et al.[21], who investigated 50 pregnant women inthe firsttrimester selected from the outpatient clinic and the in-patient wards of Ain Shams University Hospital in Egypt. Twenty subjects had hyperemesis gravidarum, 20 women experienced vomiting, though not severe enough to be diagnosed with hyperemesis gravidarum, and 10 were healthy pregnant women serving as control subjects. No statistically significant difference was found in levels of FT3, TSH, and antithyroid peroxidase (anti-TPO) antibodies ($p > 0.05$) among the three groups of women.

Only the difference in FT4 levels reached statistical significance, with elevated levels found in the group withhyperemesis gravidarum compared with the emesis group and the healthy control group ($p < 0.05$). However, these higher free T4 values did not exceed the normal range. The researchers attributed this elevated free T4 level in the hyperemesis gravidarum group to the pattern of serum free T4 changes typically seen during normal pregnancy, namely a slight, transient increase in free T4 levels in the first trimester (because of hCG's stimulating effect on the thyroid) and the fact that serum free T4 values tend to diminish as pregnancy progresses past the first trimester. In addition, although they found greater serum ßhCG levels in the hyperemesis gravidarum group than in the other two groups, the difference did not reach statistical significance($p>0.05$). The serum ßhCG levels in the women with hyperemesis gravidarum did not correlate significantly with their levels of serum TSH, free T3, and free T4.In the healthy controls, the only positive correlation found was between their ßhCG and free T3 levels ($r=0.755$, $p<0.05$). In the hyperemetic group,the best significant cut off point of free T4 was 1.06 ng/dL (sensitivity = 80%; specificity = 80%; $p<0.004$), which still falls within the normal range for free T4 values. Their evidence suggests that neither hCG nor thyroid hormones play a pathogenic role in hyperemesis gravidarum. Instead, they called for more research intothe possible roleof serum leptin in the development of the condition.

There is also a difference between the findings of the present study and those of Aka et al. [22], whose study in Turkey involved 18 women with hyperemesis gravidarum and 18 healthy pregnant women serving as controls.They found no differences in the thyroid hormone and serum hCG levels between the two groups.

Another Turkish study, Taskin et al. [23], also reported findings different from those of the current study. They foundboth serum TSH and serum ßhCG levels to be greater in hyperemeticwomenthan in healthy pregnant women, while free T3 and T4 levels of the two groups were not significantly different. However, their study involved only 20 patients with hyperemesis gravidarum and 20 women with normal pregnancies.

The current findings are also at odds with Wilson et al. [24]. In this UK study on 10 women with hyperemesis gravidarum and 50 healthy pregnancy women, some abnormal thyroid function levels were observed in individual patients, but these were not significantly different from levels found in the healthy controls. In addition, there was no consistent pattern of thyroid abnormality in the hyperemetic group.

Earlier studies also reported findings different from our own. Valbo and Jerve [25]found pathological levels of TT4 in seven of twelve women (58%) hospitalized for hyperemesis. In only three of the patients were free T4 levels elevated and all of the patients had T3 values within the reference range. Thus, they argued that these pathological values of T4 and free T4 are not indicative of thyroid disease.

These different findings may be partly due to the limited number of subjects in these earlier studies as well as differences in defining the condition, deciding at which point the symptoms of morning sickness become severe enough to be classified as hyperemesis gravidarum.

## CONCLUSION

In the present study, none of the women exhibited signs of thyrotoxicosis. However, analysis of thyroid functions showedhighly significant differences in FT3, FT4 and TSH levels between the case and control groups.

Ketonuria was found in all the hyperemetic patients, and electrolyte disturbance and elevated liver enzymes were also common.

Hyperthyroidism was clearly detected in the present study, but it did not reach levels requiring antithyroid medication. However, it appears that this gestational transient mild hyperthyroidism may contribute to hyperemesis gravidarum and may explain why it continues into the second trimester.

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